Association Connecting Electronics Industries

IPC®

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IPC-TM-650
TEST METHODS MANUAL

Number **2.3.28**	
Subject **Ionic Analysis of Circuit Boards, Ion Chromatography Method**	
Date **11/12**	Revision **B**
Originating Task Group **Ionic Conductivity / Ion Chromatography Task Group (5-32a)**	

1 Scope This test procedure is designed to measure the level of extractable ionic contamination on the surface of printed boards and printed board assemblies by ion chromatography.

2 Applicable Documents

IDEMA M13-99 Measurement of Extractable/Leachable Anion Contamination Levels on Drive Components by Ion Chromatography (IC)

IPC-TP-1043 Cleaning and Cleanliness Test Program, Phase III, Water Soluble Fluxes, Part 1: B-24, Interactions of Water Soluble Fluxes with Metal/Substrates

IPC-TP-1044 Cleaning and Cleanliness Test Program, Phase III, Water Soluble Fluxes, Part 2: B-36, Comparison to Phase 1 Rosin Benchmark

IPC-TR-583 An In-Depth Look at Ionic Cleanliness Testing

IPC-5701 Users Guide for Cleanliness of Unpopulated Printed Boards

IPC-WP-008 ''Setting Up Ion Chromatography Capability''

3 Test Specimens

3.1 Printed board and/or printed board assembly for extraction

4 Apparatus and Material

4.1 Ion Chromatograph capable of accurately measuring ion concentrations down to 0.5 parts per million (ppm). The equipment and chemistry should be set up and standardized per the manufacturer's instructions. The separation column and eluent composition should be chosen to provide baseline resolution between the ions of interest.

4.2 Hot water bath capable of maintaining 80 ± 2 °C [176 ± 3.6 °F].

4.3 Clean extraction vessels.

4.4 Clean labware (Ionic free).

4.5 Cleanroom vinyl gloves. (<3 ppm of Cl).

4.6 Deionized water with a resistivity of at least 18.0 megohm-centimeter.

4.7 IC or ACS grade chemicals for eluent and regenerant preparation.

4.8 National standard - traceable calibration standards (e.g., NIST traceable).

4.9 Volumetric Flasks (Typically 25, 50, 100, and 1000ml).

4.10 Precision Pipetting Equipment (such as Eppendorf).

5 Test Procedures

5.1 Extraction Procedure Select a low-ion extraction bag sized to fit the board with approximately 2.5 cm [1.0 in] excess on each side to minimize required extract solution, with several inches at the top to allow for air expansion when the bag is heated.

Note: See **www.ipc.org/html/testmethods.htm** for an IPC-TM-650 Equipment Vendor Listing for possible vendors.

5.1.1 Use clean gloves and or tongs when handling the samples to be tested. Place each sample in an extraction bag.

5.1.2 Prepare a 75/25 (± 5%) v/v 2-propanol/H_20 solution for the extraction.

Note: A tolerance was added to the IC method because it is a more specific and accurate method by comparison to the ROSE method.

5.1.3 Add a known volume of the extraction solution to the extraction bag covering the sample (approximately 0.5 mL/cm^2 of surface area).

5.1.4 Add the same volume of extraction solution to an empty bag of the same lot for use as a blank.

5.1.5 Suspend the bags in the 80 ± 2°C [176 ± 3.6°F] water bath allowing the water to force most of the air from the bags. Do not allow any of the water from the water bath into the extract solution in the bags. Fold the top of the bags over the suspending bar and clip in place with binder clips. This will minimize solvent loss during the extraction, yet not create a sealed bag. Alternatively, the bags may be heat sealed after forcing most of the air from the bag.

5.1.6 Allow the sample to soak for one hour (-0 min., +5 min.).

5.1.7 Remove the bags from the water bath and allow the solution within the bag to cool to ambient temperature before opening.

5.1.8 Gently mix the contents. Transfer solution to virgin sample vials for analysis or pull the sample solution directly from the bag using a clean syringe for manual injections.

5.1.9 Remove the test sample from the bag using gloved hands or other clean device.

5.2 Analytical Procedure

5.2.1 The analysis of the extract solution should be done as soon as possible after extraction, but shall be no longer than four days from the extraction date.

5.2.2 Start the chromatograph per the manufacturer's recommended method and allow it to come to a stable baseline.

5.2.3 Analyze sample solutions for anion and/or cation content, utilizing best analytical technique and laboratory practices.

5.3 Calculation of Results

5.3.1 Values from the chromatograms are typically reported in parts per million (ppm, µg/mL).

5.3.2 Record the surface area of the printed board or printed board assembly. Recommended area calculations for the unpopulated printed board and the printed board assembly are the following:

Printed Board Surface Area = Length x Width x 2
Printed Board Assembly Surface Area = (Length x Width x 2) + (1 x up to 50% of the printed board area)

Great caution should be taken in interpretation and comparison of these results as assembly surface areas will often deviate by more than 10% of its' unpopulated state.

Note: There is no standardized way for estimating the surface area of components. Traditionally, values from 10 to 50% have been used for estimating component area.

5.3.3 Results may be expressed as micrograms (µg) of ion per square centimeter or micrograms (µg) of ion per square inch based on the extraction volume and the calculated sample surface area.

$\mu g/cm^2$ or $\mu g/in^2 = (SC - BL) \times Vol / Area$

Where:

SC = ppm from IC (µg/mL)
BL = ppm from the bag blank
Vol = final volume (ml)
Area = surface area (cm^2 or in^2)

Note: ''ppm'' value is actually specimen value minus blank value.

5.3.4 Report all ions quantified.

5.3.5 Report the surface area used in the calculation and the percentage increased in calculating the surface area of a printed board assembly.

6 Notes

6.1 Ions which may be included for evaluation are as follows:

Anions:
Bromide
Chloride
Fluoride
Nitrate
Nitrite
Phosphate
Sulfate

Cations:
Ammonium
Calcium
Lithium
Magnesium
Potassium
Sodium

Weak Organic Acids:
Acetate
Adipate
Formate
Glutamate
Malate
Methane Sulfonate
Succinate
Phthalate

Other ions of interest may be present.

6.2 Alternate extraction techniques (change in time, temperature, or extraction solution) may be used as agreed between user and supplier (AABUS).

6.2.1 Examples of alternate extraction times include the following:

- Ten-minute extraction (IDEMA specification for metal parts)
- Twenty-four hour extraction
- 16 hour extraction per J-STD-004

6.2.2 Examples of alternate extraction temperatures include the following:

- Ambient temperature (22 ± 3 °C [72 ± 5 °F])

6.2.3 Examples of alternate extraction solutions include the following:

- 10/90 v/v 2-propanol/DI water
- Deionized water

6.3 Ion Chromatography may be a destructive test for samples due the high temperature liquid extraction and lack of protection for electrostatic sensitive devices (ESD), moisture sensitive devices (MSD), and non-hermetically sealed devices.

Note: Caution should be taken when testing samples that are intended to be deliverable production assemblies.